LAWRENCE BERKELEY NATIONAL LABORATORY

BIOSCIENCES EXPERT ADVISORY COMMITTEE

Frances Arnold, PhD

CALIFORNIA INSTITUTE OF TECHNOLOGY

Frances Arnold is the Dick and Barbara Dickinson Professor of Chemical Engineering, Biochemistry and Bioengineering at the California Institute of Technology. Her research focuses on protein evolution, in nature and in the laboratory. She pioneered methods of directed enzyme evolution and has used evolutionary approaches to engineer a wide array of novel biocatalysts

Dr. Arnold received her PhD in chemical engineering from the University of California at Berkeley in 1985. Co-inventor on more than 30 issued U.S. patents, she has served as science advisor to 10 companies, including Gevo, Inc., which she co-founded in 2005 to develop new microbial routes to producing fuels and chemicals from renewable resources.

Dr. Arnold currently serves on the International President's Council of the King Abdullah University of Science and Technology (KAUST), as a Judge for the Inaugural Queen Elizabeth Prize in Engineering, and on the Advisory Board of the Wyss Institute for Biologically Inspired Engineering.

She has received numerous awards, including the Charles Stark Draper Prize of the National Academy of Engineering, and the National Medal of Technology and Innovation. She is a member of all three membership organizations of the National Academy of Engineering, the Institute of Medicine, and the National Academy of Sciences. She has been elected to the American Academy of Arts and Sciences.

Janet Braam, PhD

RICE UNIVERSITY

Janet Braam has a diverse scientific background, being involved in research that spans from translation medical research to basic plant cell biology. She received her PhD in Molecular Virology and Biology from the Sloan-Kettering Division of the Cornell Graduate School of Medical Sciences, elucidating the roles of influenza viral polymerase subunits. She then joined Stanford University School of Medicine as an NSF postdoctoral fellow in plant biology.

Dr. Braam's research at Stanford led to the discovery that plants turn on genes in response to touch and shed light on the importance of calcium signal transduction in mechanical perturbation responses in plants.

In 1990, Dr. Braam joined the faculty at Rice University and rose through the ranks. She has had continual federal grant support and served on diverse grant and advisory panels

Dr. Braam's research contributions include uncovering roles of calcium-binding and cell wall proteins in plant responses to environmental stress, and elucidating aspects of nitric oxide signaling, autophagy regulation, and jasmonate dependent defense. Most recently, her research focus also includes the role of the circadian clock in plant defense, the complex regulation of chlorophyll biogenesis, phytohormone regulation, and autophagy control. Her discoveries in basic plant biology have potential translational application in drug discovery, crop nutrient enhancement, and nanomaterial toxicity analysis in plants.

Joanne Chory, PhD

THE SALK INSTITUTE

Joanne Chory is a native of Massachusetts. Dr. Chory received an A.B. degree in biology with honors from Oberlin College, OH, a PhD in microbiology from the University of Illinois at Urbana-Champaign, and conducted postdoctoral research with Frederick Ausubel at Harvard Medical School. In 1988, she joined the faculty of the Salk Institute, where she has remained. Dr. Chory has served on numerous advisory committees and editorial boards. Her honors include the Award for Initiatives in Research from the National Academy of Sciences, the Charles Albert Schull Award of the American Society of Plant Biologists, the L'Oreal-UNESCO Award for Women in Science, and the Kumho Award in Plant Molecular Biology. In 2003, Dr. Chory was named Scientific American's Research Leader in Agriculture. She is a member of the U.S. National Academy of Sciences, the German National Academy of Sciences (Leopoldina), the American Academy of Arts and Sciences, and a fellow of the American Association for the Advancement of Science. She is a foreign member of the Royal Society, a foreign associate of the French Academy of Sciences and is an associate member of EMBO.

Dr. Chory is interested in identifying the mechanisms by which plants respond to changes in their light environment. These studies are relevant to plant adaptation to global climate change.

Charles Craik, PhD

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

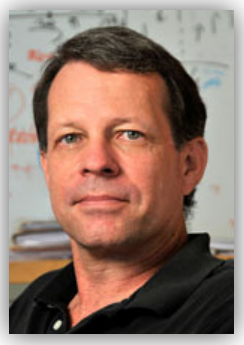
Charles S. Craik is a Professor in the Department of Pharmaceutical Chemistry at the University of California at San Francisco. He is also the founder and director of the Chemistry and Chemical Biology Graduate Program.

He joined the UCSF faculty in 1985 and has published over 280 research articles on various biochemical topics. He has co-authored two books, and served on advisory panels for the National Institutes of Health, the National Science Foundation, the National Academy of Sciences and the Department of Energy. In 2004 he founded Catalyst Biosciences and serves on its Scientific Advisory Board, along with those of CytomX Therapeutics, Protagonist Therapeutics and the Biotechnology and Enzymes Expert Committees of the US Pharmcopeia. He is a Fellow of the American Association for the Advancement of Science.

The current research in the Craik lab focuses on defining the roles and the mechanisms of enzymes in complex biological processes and on developing technologies to facilitate these studies. His study of numerous proteases, their receptors and their endogenous inhibitors has recently found practical applications in translational research in oncology and infectious diseases. The work includes developing technologies for determining the extended substrate specificity and for selectively inhibiting or monitoring enzyme activity, determining the role of a novel class of membrane bound proteases implicated in various forms of epithelial cancers, targeted inhibition of a family of human herpes virus proteases and monitoring enzymes associated with programmed cell death at the single molecule level. The reagents being developed may provide therapeutic potential in addition to their prognostic value.

Edward DeLong, PhD

MASSACHUSETTS INSTITUTE OF TECHNOLOGY



Edward DeLong serves as a Professor in two Departments, Biological Engineering & Civil and Environmental Engineering, at the Massachusetts Institute of Technology.

Professor Delong is the Goulder Family Professor in Environmental Systems at MIT and a member of the U.S. National Academy of Science. He works on developing new approaches for microbial

community genomics and systems biology. He serves as a Technical Advisor of Joule Biotechnologies Inc., and Seres Health, Inc. He also served as a Member of Scientific Advisory Board of LS9 Inc.

Ed holds a BS in Bacteriology from the University of California Davis, and a PhD in Marine Biology from the University of California San Diego.

Geoffrey Duyk, MD, PhD

TPG BIOTECH

Geoffrey Duyk served on the board of directors and was president of research and development at Exelixis where he focused on the discovery and development of small molecule therapeutics, prior to joining TPG Biotech in 2004. Prior to Exelixis, he was one of the founding scientific staff at Millennium Pharmaceuticals. As VP of genomics at Millennium, Duyk was responsible for building and leading the informatics, automation, DNA sequencing and genotyping groups as well as the mouse and human genetics group. Prior to his tenure, Dr. Duyk was an assistant professor at Harvard Medical School in Dept. of Genetics and assistant investigator of the Howard Hughes Medical Institute. While at HMS, Dr. Duyk was a co-principal investigator in the National Institutes of Health funded Cooperative Human Linkage Center.

Dr. Duyk holds a PhD and M.D. from Case Western Reserve University and completed his medical and fellowship training at UCSF. While at UCSF, Dr. Duyk was a fellow of the Lucille P. Markey Foundation and was also awarded a post-doctoral fellowship from the Howard Hughes Medical Institute.

Dr. Duyk, a partner at TPG, co-leads TPG Biotechnology, a health care oriented venture capital group with >$1bn under management. He is also the managing partner for TPG ART (Alternative and Renewable Technologies). He serves on the board of directors of number of companies including Amyris, Genomatica, Elevance and Beta Renewables.

Outside of TPG, he is a member of the Board of Trustees of Wesleyan University and serves on visiting committees at Harvard Medical School and Case Western Reserve University School of Medicine. Dr. Duyk is a member of the Board of Directors for the American Society of Human Genetics. He has also served on the council of NHGRI and a number of NIH and DOE advisory groups. He is also a member of the SAB of Jackson Labs and the SMA foundation.

Replidyne, Macrogenics, Aerie, FoldRx, Amyris, Galleon, Moksha8, ShangPharma, Agria, Renewco and JCR, council member of the National Human Genome Research Institute at the National Institutes of Health, serves on the scientific advisory boards of the NHGRI DNA Sequencing Advisory Panel, chair of the KOMP (Global Mouse TKO project), ESC (Expressed Sequenced Consortium), co-chair advisory panel Cancer Genome Anatomy Project, Program in Genomics Applications (NHBLI); the Bioethics Advisory Group at Case Western Reserve University; the Spinal Muscular Atrophy Foundation; WIL Laboratories; VLST; and FoldRx.

Dr. Duyk is a former member of the board of directors of Avidia, recently sold to Amgen.

Edward Penhoet, PhD

ALTA PARTNERS

Ed Penhoet joined Alta in 2000 as a Director and has been full time at Alta since 2008. He currently serves on the board of directors of ChemoCentryx, Immune Design, Metabolex, Scynexis and Veloxis Pharmaceuticals.
A co-founder of Chiron, Ed served as the Company's President and Chief Executive Officer from its formation in 1981 until April 1998. He served as Vice-Chair of the governing board of the Independent Citizens Oversight Committee for the California Institute of Regenerative Medicine (CIRM) from 2005 to 2010, and served as the President of the Gordon and Betty Moore Foundation from 2004 to 2008.

Ed was recently appointed to President Obama's Council of Advisors on Science and Technology (PCAST). PCAST is an

advisory group comprised of 20 of the nation's leading scientists and engineers who directly advise the President and the Executive Office of the President. PCAST makes policy recommendations in the many areas where understanding of science, technology, and innovation is key to strengthening our economy and forming policy that works for the American people.

For 10 years prior to founding Chiron, Ed was a faculty member of the Biochemistry Department of the University of California, Berkeley.
Ed is the immediate past Dean of the School of Public Health at the University of California, Berkeley. He is a member of both the Institute of Medicine of the National Academies and the American Academy of Arts and Sciences. He has co-authored more than 50 scientific articles and papers.

John Pierce, PhD

BRITISH PETROLEUM

John Pierce joined BP as Chief Bioscientist in April 2010, where he is working to develop strategies on how the company should position itself to gain maximum benefit from the application of biosciences to BP's worldwide businesses.

Prior to that time, he had a long career at DuPont commencing in 1982 as a research scientist in Central Research and Development and culminating as Vice President for DuPont Applied BioSciences and Director of Biochemical Sciences & Engineering where he had responsibility for DuPont's biotechnology research and development efforts in the production of fuels, chemicals, and materials.

Throughout his career, Pierce has focused on the integration of biological approaches with chemistry, engineering, and material sciences to create biotechnological applications in agricultural chemistry, plant genetics, and industrial chemistry. He led the move of DuPont into industrial biotechnology in the mid-90s, and has long been involved in a variety of public policy activities associated with public acceptance and governmental support of biotechnology.

Martha Schlicher, PhD

MONSANTO COMPANY

Martha Schlicher leads Monsanto's bioenergy and renewable efforts in the technology organization focused on utilizing Monsanto's scientific expertise and capabilities to support the existing corn based ethanol industry, to develop Monsanto's sweet sorghum and sugarcane product pipeline in Brazil and to identify and act upon new opportunities to create value for growers in the field of renewables.

Martha has over 23 years of direct agricultural and biofuels industry experience from previous roles at Monsanto, leadership of the National Corn to Ethanol Research Center and as the head of Technology and Business Development for a London based renewables company. Martha has held roles within Monsanto leading the Environmental and Regulatory Sciences and Regulatory Policy Groups, the Ag Biotech Crop Teams, and the US Western Corn Belt Commercial Business.

Martha has a B.S. degree in Chemistry from Indiana University, a PhD in Bio-organic Chemistry from the University of Illinois and an MBA from the Kellogg Graduate School of Management at Northwestern University. Martha serves as a Trustee for the St. Louis Academy of Science, as a member of the United States Department of Energy Biological and Environmental Research Advisory Committee, and as an industry advisor to the International Center for Advanced Renewable Energy Research at Washington University in St. Louis, the Department of Agricultural Economics at University of Missouri - Columba, the National Corn Grower Association, and the Midwest Governor Association Advisory Group.

Kate Scow, PhD

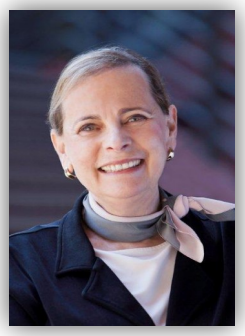
UNIVERSITY OF CALIFORNIA, DAVIS

Kate Scow is Deputy Director of the Agricultural Sustainability Institute and Director of the Russell Ranch Sustainable Agriculture Facility, and professor in the Department of Land, Air, and Water Resources (LAWR). For over 20 years, Scow's research has focused on the role of soil and subsurface microorganisms in carbon and nitrogen cycling and biodegradation of contaminants, and soil management and sustainability of smallholder farms in Uganda.

The Russell Ranch Sustainable Agriculture Facility is a unique 300-acre facility near UC Davis dedicated to long-term research on irrigated and dryland agriculture in a Mediterranean climate.

Lucy Shapiro, PhD

STANFORD UNIVERSITY



Lucy Shapiro employs a bacterial model system to probe fundamental aspects of developmental biology. Following her graduate studies in molecular biology and biochemistry, she went on to make major advances in understanding the genetic and molecular decision-making process that directs an asymmetric cell division yielding cells of different cell fates, akin to the process carried out by stem cells in higher organisms.

Dr. Shapiro's research aims to integrate the dynamic spatial organization of the cell into the complete genetic circuitry that defines cell specification and the cell cycle in *Caulobacter*. Likening the bacteria's regulatory network to the act of "playing three-dimensional chess," Shapiro and her colleagues pioneered a systems biology approach to show that the transcriptional circuitry is interwoven with the 3-D deployment of regulatory and morphological proteins. Dr. Shapiro's studies have revealed a striking similarity between the organization of cell cycle behavior in bacteria and more evolutionarily advanced organisms.

Dr. Shapiro is a professor in the Department of Developmental Biology and Ludwig Professor of Cancer Research at the Stanford University School of Medicine. Dr. Shapiro received a PhD in molecular biology from the Albert Einstein College of Medicine. Her many honors include election to the National Academy of Sciences, the Institute of Medicine, the American Academy of Arts and Sciences, and the American Philosophical Society. She is the recipient of the Waksman Award from the NAS, the Gairdner International Award, the Abbott Lifetime Achievement Award, the Horwitz Prize, and the United States National Medal of Science.

NIGMS has supported Dr. Shapiro's research since 1986.

James Tiedje, PhD

MICHIGAN STATE UNIVERSITY

James Tiedje is University Distinguished Professor of Microbiology and Molecular Genetics and of Plant Soil and Microbial Sciences, and is Director of the Center for Microbial Ecology, one of the original NSF-funded Science and Technology Centers. His B.S. degree is from Iowa State University and his M.S. and PhD degrees are from Cornell University.

His research focuses on microbial ecology, physiology and diversity, especially regarding the nitrogen cycle, anaerobic processes and biodegradation of environmental pollutants. His group has discovered several microbes that live by halorespiration on chlorinated solvents and is now using genomics to better understand microbial diversity and function. He served as Editor-in-Chief of Applied and Environmental Microbiology. He was President of the American Society for Microbiology (ASM), the International Society of Microbial Ecology, and shared the 1992 Finley Prize from UNESCO for research contributions in microbiology of international significance. He is Fellow of the AAAS, the American Academy of

Microbiology, the Soil Science Society of America, and a member of the U.S. National Academy of Sciences.

Keith Yamamoto, PhD

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

Keith Yamamoto is Professor of Cellular and Molecular Pharmacology, Executive Vice Dean of the School of Medicine, and Vice Chancellor for Research at the University of California, San Francisco. He has been a member of the UCSF faculty since 1976, serving as Director of the PIBS Graduate Program in Biochemistry and Molecular Biology (1988-2003), Vice Chair of the Department of Biochemistry and Biophysics (1985-1994), Chair of the Department of Cellular and Molecular Pharmacology (1994-2003), and Vice Dean for Research, School of Medicine (2002- 2003). Dr. Yamamoto's research is focused on signaling and transcriptional regulation by intracellular receptors, which mediate the actions of several classes of essential hormones and cellular signals; he uses both mechanistic and systems approaches to pursue these problems in pure molecules, cells and whole organisms. Dr. Yamamoto was a founding editor of *Molecular Biology of the Cell,* and serves on various editorial boards and scientific advisory boards. He serves on numerous national committees focused on public and scientific policy, public understanding and support of biological research, and science education; he chairs the Coalition for the Life Sciences and for the National Academy of Sciences, the Board on Life Sciences.

Dr. Yamamoto has long been involved in the process of peer review and the policies that govern it at the National Institutes of Health, serving as Chair of the Molecular Biology Study Section, member of the NIH Director's Working Group on the Division of Research Grants, Chair of the Advisory Committee to the NIH Center for Scientific Review (CSR), member of the NIH Director's Peer Review Oversight Group, member of the CSR Panel on Scientific Boundaries for Review, member of the Advisory Committee to the NIH Director and Co- Chair of the Working Group to Enhance NIH Peer Review -- to name a few. For NSF, he served on grant review panels for the Biology Directorate, and as an *ad hoc* member of the National Science Board Task Force on Transformative Research. Dr. Yamamoto was elected as a member of the American Academy of Arts and Sciences in 1988, the National Academy of Sciences in 1989, the Institute of Medicine in 2003, and as a fellow of the American Association for the Advancement of Sciences in 2002.